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EPR study of nanocrystalline CeO2 exhibiting ferromagnetism at room temperature

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Abstract

© 2016 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim.Electron paramagnetic resonance (EPR) spectroscopy complemented with X-ray diffraction, X-ray fluorescence, and optical spectroscopy was used to study nanocrystalline CeO2 powder samples that exhibit weak room-temperature ferromagnetism. EPR lines assigned to the Ce3+ trigonal sites were found for the first time in cerium dioxide that contains a trace impurity of Mn2+. This finding indicates that manganese dopant facilitates the conversion of the oxidation state of Ce4+ to Ce3+ in nanocrystalline CeO2. Our results support the view that Ce3+/Ce4+ pairs along with defects on the surface of nanoparticles are responsible for the ferromagnetism in CeO2. The EPR study reveals that the charge-transfer mechanism proposed recently is more suitable to explain the origin of room-temperature ferromagnetism in CeO2 than the F+-centers exchange interactions.

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Keywords

Ceria nanoparticles, Electron paramagnetic resonance, F -centers +, Room-temperature ferromagnetism